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LOWER-STRATOSPHERIC/UPPER-TROPOSPHERIC EXCHANGE PROCESSES ASSOCIATED WITH TROPICAL CYCLONES AS OBSERVED BY TOMS

Edward B. Rodgers
NASA/Goddard Space Flight Center

Total ozone associated with western Atlantic and Pacific tropical cyclones at various stages of development were analyzed for the purpose of monitoring storm intensity and/or intensity changes. The analysis is based on total ozone measurements from the Nimbus 7 Total Ozone Mapping Spectrometer (TOMS).

Since ozone may be considered a passive tracer in the lower stratosphere and the ozone gradients are strongest just above the tropopause, fluctuations of total ozone are due to variations in tropopause height and/or changes in concentration within the column caused by vertical and horizontal advection. In the subtropical northern Pacific (±30° longitude of 180°) during August and September 1981 (the time of maximum tropical cyclone occurrence), a negative correlation > 0.60 was found between upper-tropospheric geopotential heights near the tropopause level and total ozone.

Preliminary analysis of several tropical cyclones revealed the following:

1. Horizontal variation of total ozone above a mature tropical cyclone during the summer months over the subtropics were > 10% of the average total ozone amount.

2. The location and relative strength of the subtropical upper-tropospheric troughs can be monitored using TOMS.

3. Tropical cyclone intensification appears to be related to the juxtaposition between the tropical cyclone and the TOMS-observed troughs.

4. Total ozone minimum appears to be associated with increased tropopause height above the storm's central dense overcast (CDO), which is related to storm intensity.

5. Around the periphery of the CDO, a minimum in total ozone is usually observed.

6. Maximum of total ozone is observed over the eye in some very intense storms.

7. Horizontal divergence/convergence associated with the induced secondary circulation around the outflow jets corresponds to areas of minimum/maximum total ozone, respectively.

Thus, preliminary results suggest that TOMS can be used to resolve the upper-tropospheric structure in and around tropical cyclones and can provide an indication of those processes that help to intensify and maintain these storms.